In a preliminary report on the Geology of Essex County, N. Y., Kemp[12] describes the occurrences of the gneisses, limestones, ophicalcites, gabbros, lamprophyres and other igneous rocks of the district, and gives an account of their geological relationships.

GEOLOGY AND PALEONTOLOGY.

Bear River Formation.—The explorations of Mr. Stanton and Mr. Charles White in the Bear River Valley have been the means of correcting a long standing error among geologists concerning the taxonomic position of strata known as the Bear River Formation. A summary of the facts as presented by Mr. White in a late Bulletin of the U. S. Geol. Survey shows that the formation under discussion is not Laramie, to which age it has been hitherto been referred, but belongs to the Upper Cretaceous, at or near the base of that series. That is its position has been determined by Mr. Stanton as beneath the Colorado formation, and above that series of Jurassic strata which occurs within a large part of the interior region of North America generally regarded as of Upper Jurassic age and which in the general section given is called "Dakota?" This accords with the reputed age of a formation in Hungary, whose fauna is more nearly like that of the Bear River series of strata than of any other known.

Mr. White, therefore, defines the Bear River series as a distinct formation stratigraphically, geographically, and paleontologically, and states in detail its taxonomic position. All the known fossils of the formation are described and figured, comparisons are made of its fauna with those of other nonmarine formations of this and other continents, and relevant biological questions are discussed.

In making a general comparison of the Bear River fauna with the other nonmarine fossil faunas of North America, Dr. White calls attention to those features of the Bear Fauna by which it differs conspicuously from all the others. Reference is here especially made to the Auriculidæ and Melaniidæ, because it is members of these two families that give the Bear River Fauna its most distinctive character. In this connection the author remarks "this faunal character is all the more conspicuous because, of the six genera which represent those two families, only two of them are known in any other North American fauna, either fossil or recent."

[12] Report of State Geologist [of New York] for 1893, p. 433.

The similarities and contrasts between the fauna of the Bear River formation and those of the other nonmarine beds of North America leads to a discussion of their causes. The author suggests that certain genetic lines of descent have become diverged from the main lines of succession and destroyed by some of those physical changes which mark successive epochs, and adds "we may reasonably assume that one of those divergent lines terminated in the Bear River fauna; that is, at the close of the Bear River epoch the area which its nonmarine waters had occupied having become overspread by the marine waters in which the Colorado formation was deposited, it is not probable that any fluvial outlet of the former nonmarine waters was perpetuated, and there was, therefore, no provisional habitat in which the Bear River fauna might have been preserved. It was probably in this way that the distinguishing types of that fauna became extinct, together with others of its members which were not so specially characteristic of it." (Bull. U. S. Geol. Surv. 128, Washington, 1895.)

On the Occurrence of Neocene Marine Diatomaceæ near New York.—The rocks which contain Diatomaceæ (or Bacillariaceæ) in America are clayey, that is to say they contain more or less of clay, and they vary in color from a nearly white to a fawn color and to a greenish, greyish-brownish or almost black. They are not older than the Oligocene nor newer than the Plistocene. They can be placed in the Neocene, a period that ranges from the Eocene to the Plistocene, and not in the recent. Those I have to describe in New York are not Miocene, but they belong to a place which may provisionally be classed as Pliocene or Plistocene of the European geologists.

Ever since 1843, the so-called infusorial earth has been known in Virginia and was thought by Rogers the discoverer to be Miocene Tertiary, he classifying it as the European rocks were. Bailey accepted the classification and so did the later geologists. When fresh water fossil Diatomaceæ were found in Massachusetts they were thought to be Miocene also without studying the rocks themselves and seeing how they stood in the geological scale. When they were found in New Hampshire I did not classify them nor did Hitchcock attempt to do so. They were placed in the lacustrine Sedimentary and provisionally in the Recent. But now they can be seen to be older than the Recent and must be placed in a position by themselves. In the Iceberg period, the Champlain, when the ice which covered the country was beginning

to melt, icebergs which formed by the breaking off of the ice on the border were common. The icy water had Bacillariaceæ in it, for they existed, as they do now, when the temperature was at 0° C. This flowed down to the lower regions from the north and northwest.

In California I did not classify the rocks containing the Bacillariaceæ leaving that to the older and more experienced geologists. Blake, who had discovered them at Monterey, supposed them to be Miocene, for he saw as Bailey showed them to be similar to the Virginian ones. In Japan where I discovered them also I failed to classify them for Pumpelly, who had brought them home did not place them likewise. When the infusorial earth was found in Florida, it had also been placed in the Miocene Tertiary by Bailey. And when I had it from that state subsequently at Manatee, I failed to classify it because I had not visited the spot where it came from myself. Now I believe these are older than what is called the Miocene. And I am confirmed in this supposition by what Towney said of the Virginia stratum. I prefer to place them as far back as the Upper Eocene, the Oligocene as it is called. In New Jersey at Asbury Park and Atlantic City the infusorial earth has been found by Woolman and classified by him as Miocene. But further north on the Atlantic side of the continent it has not been seen. I examined the clay that was dug at about two feet down at Foley's, South Beach, Staten Island, N. Y., but although it contained marine Bacillariaceæ it was not what I wanted. I thought it belonged to the Raised Coast period. At Martha's Vineyard, Mass. the clay classed as Miocene by Dall did not contain any Bacillariacæ.

It was on the 11th of August, 1895, that I visited Rockaway to get rest from the turmoil and heat of the city. Rockaway is a beach or promontory which extends down from a place called Far Rockaway southwards on the coast of Long Island. Long Island is made up of hills of no great height extending down the middle or on the north shore of the island. A low range of country extends down the southern shore where the Atlantic Ocean begins. It is fringed by sandy bars which are mostly islands. These islands extend down the coast from Cape Cod, Mass. to Florida. Key West is the most southern of the islands which are known in Florida as Keys. The country on the Atlantic side of the island is low, sloping down to the coast without any elevation in it.

I knew that I should go down by rail cutting through the hills until I came transversely to the island to the promontory of Rockaway. It is true that I wanted to get out of the cities heat but I had also two other reasons for going. I wanted to study the glacial phenomena which I

knew would present themselves there. At the same time I desired to search for the infusorial earth. At one place we came to a kettle hole, at the Lutheran Cemetery. I was sure it was a kettle hole and knew there was clay, a Lacustrine Sedimentary deposit of Diatomaceæ, at the bottom. I saw the glacial moraine made up of gravel and sand all along the road. The moraine was a gravelly till with boulders scattered through it. On the top it was capped by a layer of about three feet thick of whitish clay. This I knew to be diatomaceous, the same as covers the country in New Jersey and on Manhattan or New York Island. As we approached the station known as Brooklyn Hills we cut through three high hills which I saw then and afterwards were made up of moraine stuff, mostly gravel, with a white clay about three feet thick on top. The clay was the same as we had just passed. It makes the bottom of the glacial clay, the Lacustrine Sedimentary deposits of Diatomaceæ. In this moraine I afterwards got a small distinctly striated boulder and near the bottom of the hill, about twelve feet from the bottom was a grey clay with Hematite nodules in it. Cretaceous clay no doubt.

The country became flat with no rising in it and sloping gradually towards the coast where we came to the station known as Aqueduct. Cretaceous clay underlies the country doubtless covered by glacial till or moraine. At Aqueduct the railroad runs out on tressels to Rockaway. At Rockaway Beach I landed and wandered south on the promontory but found nothing but white siliceous sand, they were not digging anywhere that I could find. I wandered north in the direction of Far Rockaway where the land became higher and was covered by the whitish Iceberg period clay which evidently came from the north-west. At Auvergne they had been digging a ditch to reclaim the land from the sea. This was on the opposite side of Rockaway to the Atlantic Ocean, on Jamaica Bay. The digging was over six feet deep. They had thrown out some of the Iceberg clay and below that some greyish soil without any stones in it. I saw at once that it was different in character from the soil on the marshes and which I had learned belonged to the Raised Coast or Champlain Period. I took some home and examined it and came to the conclusion that I had found what I was in search of, the infusorial earth. It was no doubt what may be termed Pliocene Tertiary and belonged to the Neocene Period.

I cleaned some and found the following Bacillariceæ in it besides some forms of *Dictyota*, which are Radiolaria. So me few usual forms escaped me but will probably be found hereafter.

Achnanthes subsessilis C. G. E.
Actinocyclus ehrenbergii J. R.
Actinoptychus undulatus C. G. E.
Auliscus cœlatus J. W. B.
Auliscus pruinosus J. W. B.
Auliscus radiatus J. W. B.
Aulacodiscus germanicus C. G. E.
Amphora ovalis F. T. K.
Amphiprora elegans W. S.
Amphiprora navicularis C. G. E.
Amphiprora pulchra J. W. B.
Biddulphia aurita A. B.
Biddulphia pulchella G.
Biddulphia rhombus W. S.
Cerataulus radiatus J. R.
Cerataulus smithii W. S.
Cerataulus turgida W. S.
Coscinodiscus asteromphalus C. G. E.
Coscinodiscus excentricus C. G. E.
Coscinodiscus subtilis C. G. E.
Coscinodiscus lineatus C. G. E.
Coscinodiscus nitidus W. G.
Cocconeis scutellum C. G. E.
Cyclotella striata F. T. K.
Dicladia mitra J. W. B.
Doryphora amphiceros F. T. K.
Epithemia turgida F. T. K.
Epithemia musculus F. T. K.
Eunotia monodon C. G. E.
Euotiogramma amphioxys C. G. E.
Fragillaria pacifica A. G.
Grammatophora marina F. T. K.
Hyalodiscus franklinii C. G. E.
Hyalodiscus stelliger J. W. B.
Isthmia enervis C. G. E.
Melosira sulcata C. G. E.
Navicula clavata A. G.
Navicula didyma C. G. E.
Navicula elliptica F. T. K.
Navicula hennedii W. S.
Navicula humerosa A. B.
Navicula lacustris W. S.
Navicula lata A. B.
Navicula peregrina F. T. K.
Navicula permagna J. W. B.
Navicula viridis C. G. E.
Nitzschia acuminata W. S.
Nitzschia balanotis A. G.
Nitzschia sigma F. T. K.
Nitzschia tryblionella H.
Plagiogramma gregoriana R. K. G.
Pleurosigma angulata W. S.
Pleurosigma balticum C. G. E.
Pyxilla? *baltica* A. G.
Pyxidicula compressa J. W. B.
Rhabdonema arcuatum F. T. K.
Roicosphenia currata F. T. K.
Scoliopleura tumida L. R.
Schizonema fœtida J. E. S.
Stauroneis aspera C. G. E.
Stauroneis birostris C. G. E.
Stephanopyxis appendiculata C. G. E.
Stephanopyxis turris J. R.
Surirella febigeris F. W. L.
Surirella striatula B. V.
Synedra affinis F. T. K.
Terpsinoe americana J. W. B.
Triceratium alternans J. W. B.
Triceratium favus C. G. E.
Triceratium maculatum F. T. K.
Triceratium punctatum T. B.

These are all the Bacillariaceæ that I have detected up to this time. There are several forms of *Dictyocha*, a genus of Radiolaria, present

also. And what I consider a new genus of Bacillariaceæ, which I have called *Ancile radiata.* It is free and found rarely in the salt water in Jamaica Bay, Rockaway and at Foleys, and South Beach, Staten Island. But of this I shall speak hereafter. Mr. W. A. Terry says he has found broken fragments of *Brunia* but this I myself have not seen, although common in a deposit which I will also describe hereafter taken at fifteen feet from the surface at Hoboken, N. J, I, another day, visited Coney Island, N. Y., and searched for infusorial earth and this time was fortunate enough to find it at Sheephead Bay, which is a village just on the Long Island side of Coney Island Creek. It was a grayish colored clay, one foot underneath the sand taken at low water, about eight feet from the surface of the soil. At Canarsie Landing, which is on Jamaica Bay between Coney Island and Auvergne, I did not find the infusorial earth, but I was there a very short time. I did find glacial phenomena and indication of the elevation of the coast, but of those I shall not speak now as they are not microscopical. But the finding of Bacillariaceæ in the infusorial earth, as belonging to the Upper Neocene period, is thus a fact, and the date of so finding is worthy of record. Perhaps they will be found more inland on Long Island hereafter. I have searched for them as far inland as the city of Jamaica, but without result.

This layer is in the Upper Neocene, or perhaps the Plistocene, but the placing of it definitely is extremely difficult if not impossible at present, for on describing a fossil marine Diatomaceous deposit from St. Augustine, Florida, Mr. Charles S. Boyer says (Bulletin of the Torry Botanical Club, April, 1895, Vol. 22, No. 4, page 172) that it, the St. Augustine deposit, "overlies an Eocene deposit and is beneath the Plistocene" and that the Barbadoes deposit, which corresponds partially with it, "is now claimed to be Pliocene." In fact, as I have already pointed out, the marine fossil layers of Bacillariaceæ, be it from Mors, Denmark; Simbirsk, Russia; Sentz Peter, Austria; Oran, Algiers; Moron, Spain; Argentina; Payta, Peru; New York to Virginia, California and New Zealand, including the Nicobar Islands, are Neocene, be that Miocene or Pliocene.

—Arthur M. Edwards, M. D., Newark, N. J.

The succession of Glacial changes.—Evidence has been accumulating during the last few years in favor of the periodicity of glacial action. Mr. Geikie recognized in Europe six distinct glacial epochs separated by genial periods, making in all eleven glacial and interglacial stages. For convenience he gives each of these horizons a separate name. The climax of glaciation was reached in the third

stage, that is, the second glacial epoch, after which the cold stage diminished continuously in importance. In like manner, the earliest interglacial epoch seems to have been the most genial, each successive epoch approximating more and more closely to existing conditions.

The American glacial deposits have been classified by Mr. Chamberlin, and an attempt made to correlate them with those of Europe. The following table shows the tentative correlation.

GLACIAL AND INTERGLACIAL STAGES.

EUROPEAN.	AMERICAN.
XI. Upper Tubarian=Sixth Glacial Period.	
X. Upper Forestian=Fifth Interglacial Period.	
IX. Lower Turbarian=Fifth Glacial Epoch.	
VIII. Lower Forestian=Fourth Interglacial Epoch.	
VII. Mecklenburgian=Fourth Glacial Epoch.	Wisconsin.
VI. Neudeckian=Third Interglacial Epoch.	Toronto.
V. Polandian=Third Glacial Epoch.	Iowan.
IV. Helvetian=Second Interglacial Epoch	Aftonian.
III. Saxonian=Second Glacial Epoch.	Kansas Formation.
II. Norfolkian=First Interglacial Epoch.	
I. Scanian=First Glacial Epoch.	

The complex series subsequent to the Wisconsin formation have not been sufficiently investigated to permit even a tentative correlation, or indeed, to even designate the specific formations. This statement is equally applicable to the formations deposited during the advancing stages of the glacial period in America. (Journ. Geol., Vol. III, 1895.)

Geologic News.—PALEOZOIC.—Haworth proposes to divide the Coal Measures of Kansas into Upper and Lower, the division to be at the top of the Pleasonton shales, which is at the bottom of the Erie limestone. The division is based principally on paleontological evidence. In the author's study of the Kansas Coal Measures he finds that the shales are of submarine origin, while the entire formation appears to have been laid down during a period of gentle oscillations, with the greatest movement to the west, and the least to the east. (Kan. Univ. Quar., Vol. III, 1895.)

An Orthoceras shell of gigantic proportions has been found in the Lower Coal Measures of Iowa, about forty miles from Des Moines. This specimen is three inches in diameter and as it is of the same very slender as the associated forms, it could not have been less than six feet in length, and probably was even longer. The species is *O. fauslerensis.* (Science, Jan., 1896.)

MESOZOIC.—In examining the microscopic structure of the flint nodules found in the Lower Cretaceous of Texas near Austin, Mr. J. A. Merrill found traces of the following organisms: Foraminifera, sponges, molluscs represented by the nacreous tissue of the shells, and fishes represented by their scales. The fact that the delicate spines of the sponge spicules, even to the most minute barb are perfectly preserved, showing no trace of having been subjected to mechanical movement, leads to the conclusion, that these flints result from the continuous growth of sponges *in situ.* Mr. Merrill's study then confirms to this extent the view taken by Prof. Sollas in his study of the nodules of the English flint. (Bull. Harvard, Mus. Comp. Zool., Vol. XXVIII, 1895.)

CENOZOIC.—Mr. G. H. Ashley's studies of the Coast Range Mts. of California lead him to the conclusion that the east and west ranges of Santa Barbara, Ventura and Los Angeles counties were elevated at about the end of the Miocene, while the ranges to the north with a uniform strike of northwest and southeast were elevated at or near the end of the Pliocene. (Geol. Mag., Vol. III, 1895.)

Mr. A. M. Edwards reports Cenozoic clay containing marine forms of diatomaceæ from Rockaway, Long Island. The clay deposit is dark green or grey in color, and is capped by a fresh water deposit of white clay. (Observer, Dec., 1895.)

Prof. H. L. Fairchild enumerates eight reasons for regarding the Pinnacles Hills, near Rochester, N. Y. as a kame series forming a part of a frontal moraine. This is contrary to the views of Upham who considers that they were deposited "in the ice-walled channel of a stream of water," "open to the sky." (Amer. Geol., Vol. XVI, 1895.)

BOTANY.[1]

A recent paper on the relation between the Ascomycetes and Basidiomycetes.[2]—In the October number of the *Revue Mycologique* under the heading "A Fungus simultaneously an Ascomycete and Basidiomycete" appears a résumé by R. Ferry of a portion of

[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

[2] Read before the Botanical Seminar of the University of Nebraska, Dec. 21, 1895.